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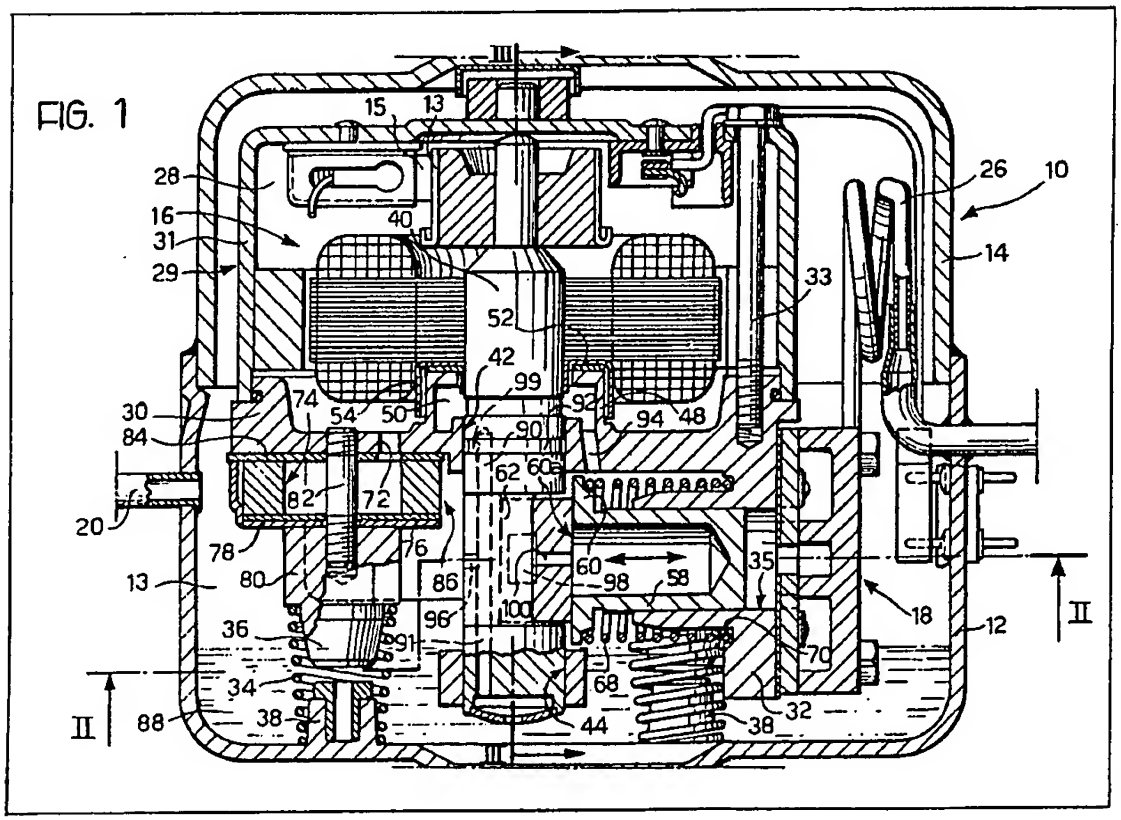
(54) Sealed motor-compressor unit for refrigeration systems

(57) A sealed motor-compressor unit for refrigeration systems in which a direct current motor (16) and the reciprocating compressor (18) are in separate chambers (28, 13) which intercommunicate through an annular filter element (72) of sintered zinc. The drive from the motor is transmitted to the compressor by means of a circular eccentric cam (62) which engages in a semi-circular recess in a shoe (66) which slides on the base of the compressor piston (58). A spring (68) maintains contact between the cam and the shoe.



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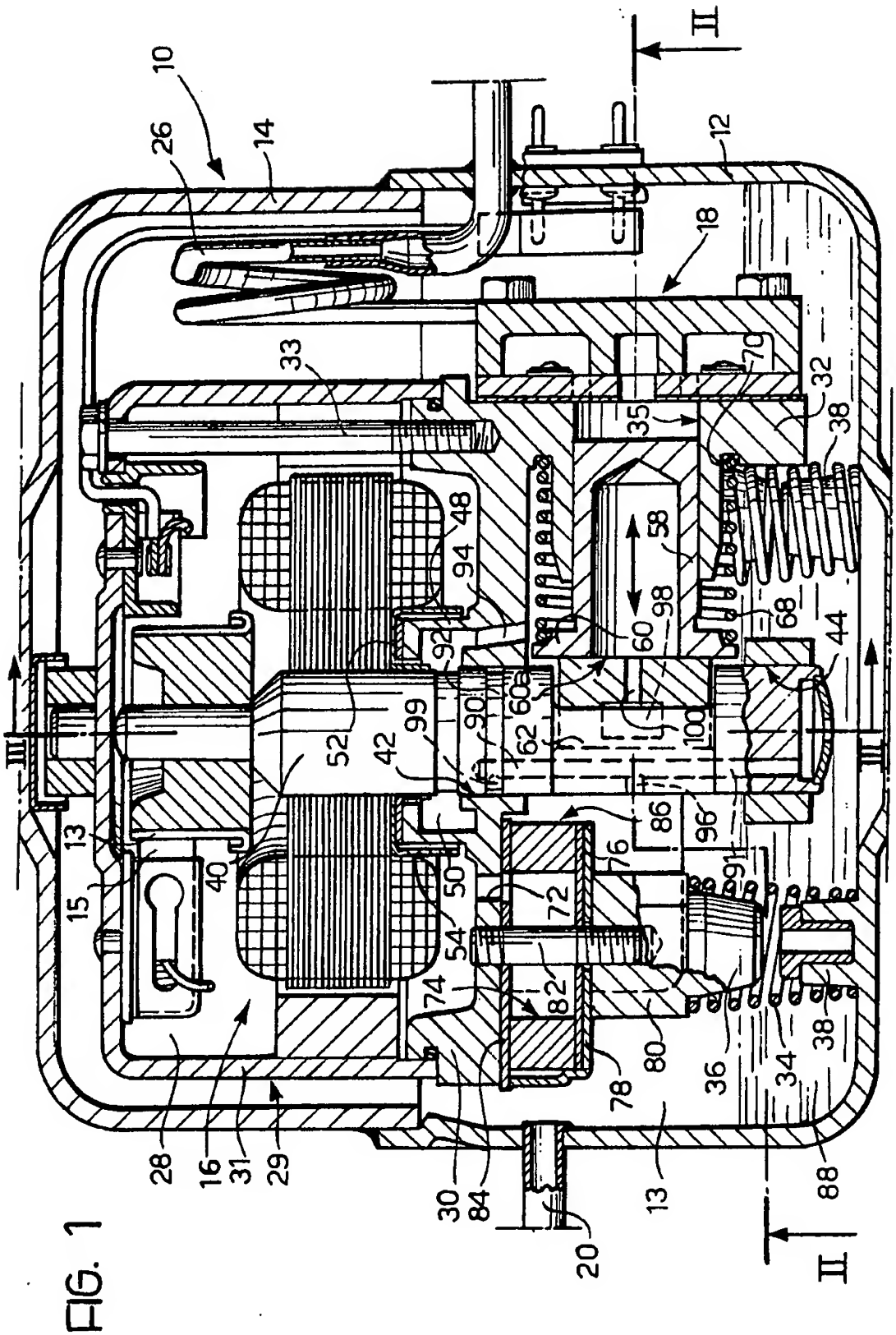

FIG. 1

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FIG. 2

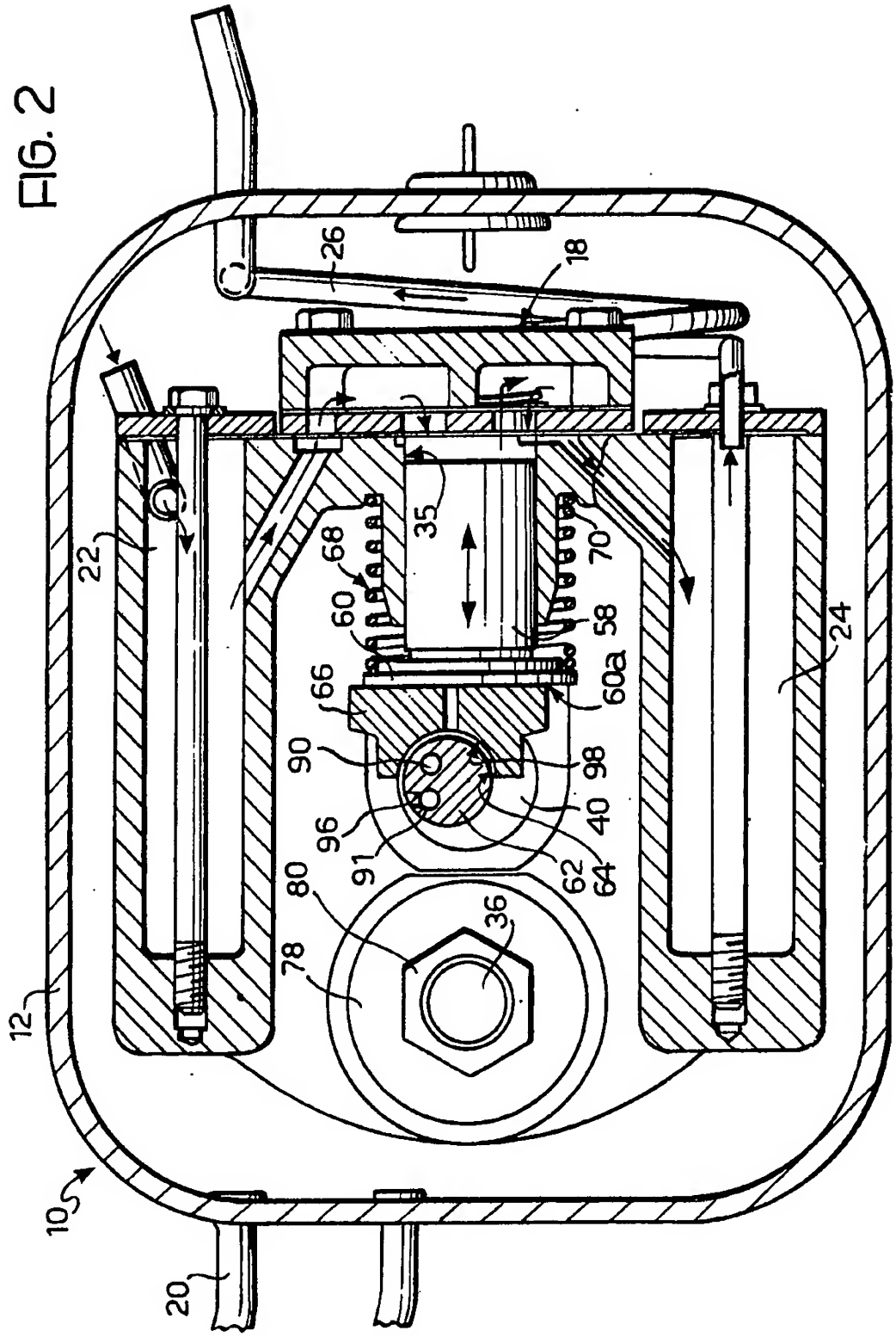
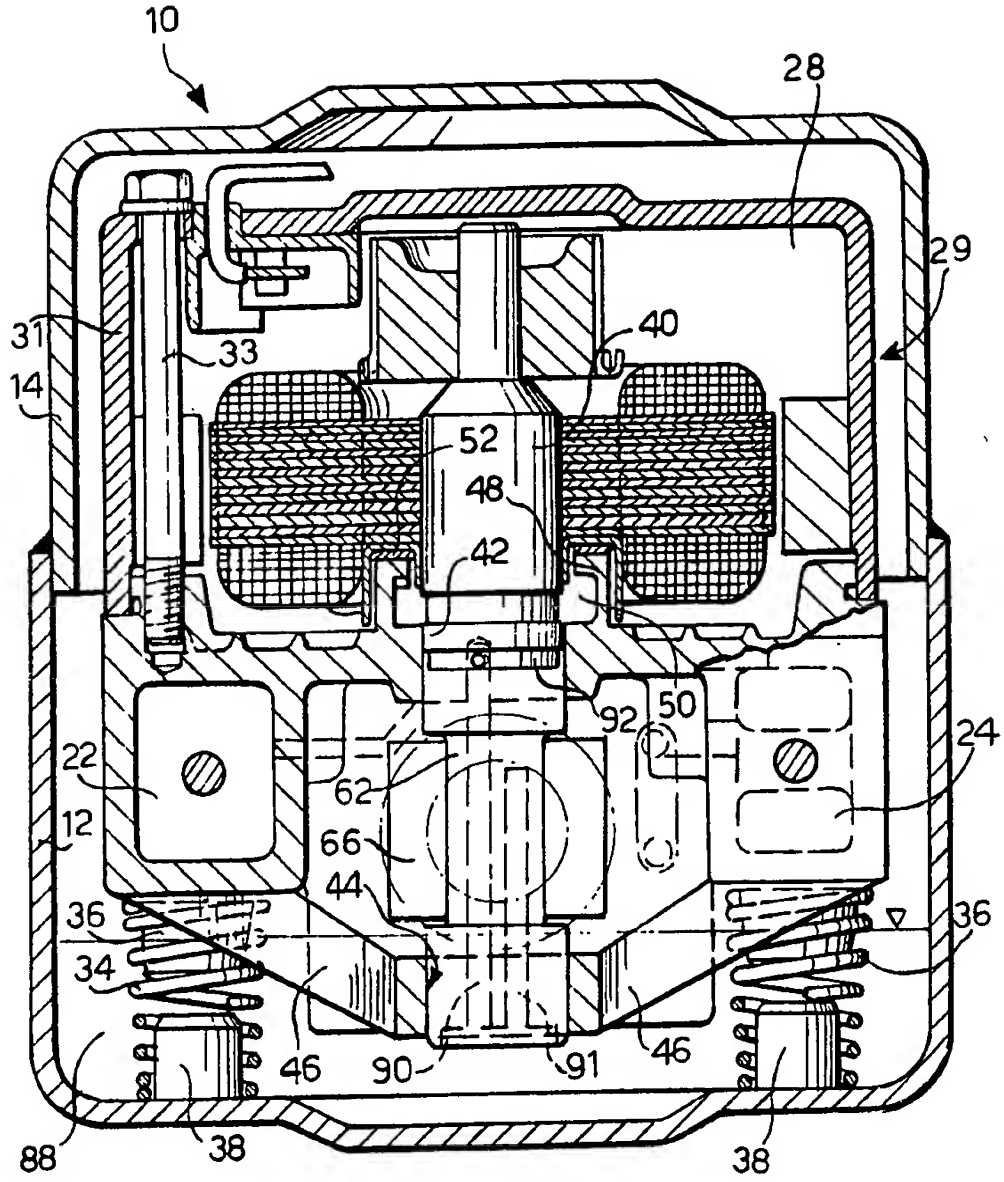


FIG. 3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SPECIFICATION

Sealed motor-compressor unit for refrigeration systems

This invention relates to sealed motor-compressor units for refrigeration systems.

The invention relates in particular to a sealed motor compressor unit of the kind which consists of a sealed housing enclosing two chambers separated from each other by a separating wall, one chamber containing a direct current electric motor with a commutator and brushes which transmits drive, via a drive shaft, to a compressor contained within the second chamber, sealing means interposed between the shaft and the separating wall, and absorption means contained within the casing for chemical absorption of the products arising from decomposition of the refrigerant fluid caused by sparking between the commutator and brushes.

A motor-compressor unit of the kind specified above is known from U.S. Patent Specification No. 4,020,645. In the unit described in this Patent the absorption means consist of sintered plates of a strongly electro-positive metal, such as zinc affixed to a wall of the chamber containing the motor, adjacent the commutator.

This arrangement of the absorption means does not ensure satisfactory absorption of the aforesaid decomposition products, which are liable to damage the compressor and the other components of the refrigeration system.

An object of the present invention is to provide an improved motor-compressor unit which affords almost total absorption of the aforesaid products of decomposition.

With a view to achieving this object, the present invention provides a motor-compressor unit for refrigeration systems of the above specified type, characterised in that the two interior chambers communicate with each other through at least one opening in the separating wall and in that the said absorption means are in the form of a filter element cooperating with the said opening so as to act upon the fluid flowing through the opening from one chamber to the other in order to prevent products of decomposition formed in the motor chamber from reaching the compressor chamber.

The present invention particularly is applicable to a motor-compressor unit in which the compressor consists of a cylinder and piston, with means for converting the rotary motion of the electric motor shaft into reciprocating linear motion of the piston. According therefore a preferred embodiment of the invention, the said means consist of an eccentric circular cam mounted on the drive shaft which engages in a semi-cylindrical cavity of a shoe which abuts on a flat end face of the piston facing towards the drive shaft and which is slidable upon the said end fact in directions perpendicular to the axis of the cylinder and resilient biassing means urging the piston towards the drive shaft.

This characteristic avoids the noise which arises in existing units from play between the connecting rod of a conventional drive system and the motor of the compressor. The motor-compressor unit of the present invention will thus be especially advantageous where quiet running is required, such as, for example, refrigerators intended for installation in caravans or small pleasure boats.

The invention will now be described by way of non-limiting example, with reference to the accompanying drawings, in which:

Figure 1 is a medial axial sectional view of a motor-compressor unit according to one embodiment of the invention;

Figure 2 is a section taken along the line II—II of Figure 1, and

Figure 3 is a section along the line III—III of Figure 1.

Indicated at 10 in its entirety is the sealed housing of a motor-compressor unit for refrigeration systems, arranged with its axis vertical. This housing 10 is in two halves 12 and 14 which are welded together. The motor-compressor unit consists of a direct current electric motor 16 of the kind having a commutator 13 and cooperating brushes 15 which drives a compressor 18 of the reciprocating piston type. The compressor 18 causes a refrigerant fluid to circulate in a refrigerator system comprising, *inter alia*, an evaporator and a condenser (not illustrated) connected to the motor compressor unit *via* two pipes 20 and 26 respectively. The pipe 20 leads into the interior chamber 13 of the housing 10, within which the compressor is mounted. The interior chamber 13 is in communication the chamber of a first silencer cylinder 22 which in turn communicates with the intake of the compressor 18. The delivery outlet of the compressor 18 is connected to the chamber of a second silencer cylinder 24 which in turn in connected to the aforesaid pipe 26 leading to the condenser (not shown).

Indicated as 29 is an inner casing contained inside the housing 10 and consisting of a separating wall 30 and a half-shell 31, joined together by bolts 33. This casing 29 has an internal chamber 28 which contains the electric motor 16. Indicated at 32 is a block, integral with the separating wall 30, in which the cylinder 35 of the compressor 18 is machined. The casing 29 and the block 32 bearing the compressor 18 are flexibly mounted on springs 34 which are attached to the base of the housing 10. The ends of these springs 34 are engaged on centering studs 36 fixed to the separating wall 30 and to the block 32, and on centering studs 38 fixed to inside of the housing 10. Shown as 40 is the vertical drive shaft of the electric motor 16. This shaft 40 is mounted on a main bearing 42 fixed to the separating wall 30 and a main bearing 44 mounted between two brackets 46 fixed to the block 32. A hollow cylindrical boss 48 is integral with the separating wall 30 and encloses an internal annular chamber 50. The boss 48 has an

upper annular end wall upon which an annular sealing element 52 of a self-lubricating material is supported. The sealing element 52 may for example, consist of a fluoride resin of the kind known commercially as "Rulon" made by the Dixon Corporation of Bristol/RI, USA. A metal protective sleeve 54 is fitted onto the boss 48 and over the sealing element 52.

The compressor 18 has a piston 58, the base of which is fitted with an annular external flange 60 having a flat end face 60a, facing towards the motor drive shaft 40. The drive shaft 40 bears, in correspondence with the piston 58, an eccentric circular cam 62 which engages in a semi-cylindrical cavity 64 in a shoe 66 having a flat face which abuts the said flat end face 60*a* of the piston 58. The shoe 66 is thus free to slide on the said end face 60*a* perpendicularly to the axis of the cylinder 35.

A helical biassing spring 68 surrounds the cylinder 35 and is interposed between the annular external flange 60 of the piston 58 and an annular seating 70 around the head of the cylinder 35.

An opening 72 is formed in the separating wall 30 and communicates with the interior of an annular absorption filter element 74 housed within the chamber 13 of the compressor 18. The annular filter element 74 has cylindrical outer and inner lateral walls, and is preferably made of sintered zinc. The filter element 74 is enclosed in a cover 78 having a lateral opening 86, the cover 78 being applied with an interposed seal 84.

The pack consisting of the filter element 74 the seals 76 and 84 and the cover 78 is clamped against the separating wall 30 by means of a screw threaded stud 82 which engages at one end in a threaded hole in the separating wall 30, a clamping nut 80 being screwed to the opposite end of the stud 82. The nut 80 also bears one of the centering studs 36 of the springs 34.

Reference numerals 90 and 91 indicate two bores in the shaft 40 for the passage of lubricating oil 88 from the bottom of the housing 10 to the main bearing 42 and to the mating surfaces of contact between the cam 62 and the shoe 66. The actual surface area is less than the theoretical area because there is a shallow groove 98 in the surface of the semi-cylindrical cavity 64 of the shoe 66 into which the oil from the axial bore 91 flows via a radial hole 96. The oil passes from the groove 98 through a duct 100 (Figure 1) to lubricate the flat end face 60*a* of the piston 58 in contact with the shoe 66. Lubrication of the main bearing 44 is ensured by the fact that the oil level 88 at the bottom of teh casing 10 is higher than the said bearing, so that the latter will be continuously in a bath of oil. The oil from the axial bore 90 flows through a radial hole 99 to an annular groove 92 on the outside of the shaft 40 so as to lubricate the main bearing 42. The oil then passes into the internal chamber 50 of the boss 48, and falls by gravity through a duct 94 in the separating wall 30 on to the skirt of the piston 58, thus ensuring its lubrication. The oil then falls to the bottom of the housing 10.

During the cyclic operation of the compressor 18, pressure differences are created between the chambr 13 and the chamber 28, so that there is a continuous flow of refrigerant fluid between these chambers in both directions through the opening 72. Sparks caused by sliding of the brushes 15 on the commutator 13, decompose the refrigerant fluid contained in the chamber 28, giving rise to chemically reactive products such as chlorine, fluorine and hydrochloric and hydrofluoric acids, which can corrode the components of the compressor 18. Moreover, as a result of wear on the brushes 15, carbon powder is produced which could be harmful if allowed to circulate in the refrigeration circuit. Due to the presence of the filter 74, however, when there is a flow of the refrigerant fluid from the chamber 28 of the motor 16 to the chamber 13 of the compressor 18 there is total absorption both of the aforesaid products of decomposition of the refrigerant fluid and also of the carbon powder, since this flow is forced to pass through the filter element. Moreover, owing to the presence of the opening 72 ther is considerable reduction in the pressure differences between the chambers 28 and 13, which makes it possible to dispense with the complicated and expensive sealing means used until now, and to use a simple and economical annular sealing means 52 of self-lubricating material.

Thanks to this characteristic, apart from the fact that it is no longer necessary to lubricate the aforesaid sealing means, there is also a considerable reduction of power loss by friction since high rate springs such as were previously used are no longer necessary.

The motor-compressor unit described herein also has considerable advantages from the point of view of quiet running. The unit does not employ a conventional transmission, in which play between a drive shaft and a connecting rod causes a noticeable piston slap between the reciprocating parts and which becomes noisier with increased wear during prolonged use. In fact, the presence of the spring 68 which, is loaded during the compression stroke of the piston 58 and subsequently expands in the return stroke of the piston 58 ensures the elimination at all times of any play arising from wear so as to keep the working surfaces of the cam 62, the shoe 66, and the piston 58 constantly in contact. Moreover this motion transmission arrangement has considerable advantages from the economic point of view for its manufacture requires relative inexpensive equipment.

Although the principle of the invention may remain the same it will be appreciated that the details of construction and embodiments of the invention may vary widely from what has by way of non-restrictive example been described and illustrated without going beyond the scope of the present invention.

CLAIMS

1. Sealed motor-compressor unit for refrigeration systems consisting of a sealed

housing enclosing two chambers separated from each other by a separating wall, one chamber containing a direct current electric motor with a commutator and brushes which transmits drive, via a drive shaft, to a compressor contained within the second chamber, sealing means interposed between the shaft and the separating wall and absorption means contained within the casing for chemical absorption of the products arising from decomposition of the refrigerant fluid caused by sparking between the commutator and brushes, characterised in that the two interior chambers (13, 28) communicate with each other through at least one opening (72) in the separating wall (30) and in that the said absorption means are in the form of a filter element (74) cooperating with the said opening so as to act upon the fluid flowing through the opening (72) from one chamber to the other in order to prevent products of decomposition formed in the motor chamber (28) from reaching the compression chamber (13).

2. Unit according to Claim 1, characterised in that the absorption filter element (74) consists of a sintered body of a strongly electropositive metal.

3. Unit according to Claim 2, characterised in that the body of the absorption filter element (74) is made of sintered zinc.

4. Unit according to any one of Claims 1 to 3, characterised in that the absorption filter element (74) comprises an annular body having cylindrical inner and outer lateral walls, the said filter element (74) being housed in the compressor chamber (13) and affixed at one end face to the said separating wall (3) with the inner lateral wall of the filter element surrounding the opening (72), and cover (78) covering at least the opposite end face of the filter element (74).

5. Unit according to Claim 1, characterised in that the sealing means consist of an annular element (52) of a self-lubricating material.

6. Unit according to Claim 1, in which the compressor includes a cylinder in which a piston slides, and means for converting the rotary motion of the motor drive shaft into a reciprocal linear movement of the piston, characterised in that the said means consist of an eccentric cam (62) mounted on the drive shaft (40) which engages in a semi-cylindrical cavity (64) of a shoe (66) which abuts on a flat end face (60*a*) of the piston (58) facing towards the drive shaft (4) and which is slidable upon the said end face (60*a*) in directions perpendicular to the axis of the cylinder (35), and resilient biassing means (68) urging the piston (58) towards the drive shaft (40).

7. Unit according to Claim 6, characterised in that the resilient biassing means comprise helical spring (68) surrounding the cylinder (35) and interposed between an annular seating (70) surrounding the head of the cylinder (35) and an annular external flange (60) on the base of the piston (58).

8. A sealed motor compressor unit for refrigeration systems, substantially as herein described with reference to and as shown in the accompanying drawings.

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